Drug and Alcohol Dependence 189 (2018) 76–79

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Crude estimates of prescription opioid-related misuse and use disorder populations towards informing intervention system need in Canada

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ARTICLE INFO

Keywords:
Addiction
Canada
Misuse
Opioid use disorder
Population
Prescription opioids
Prevalence

ABSTRACT

Background: Numerous interventions aimed at addressing the Canadian 'opioid crisis' have been implemented. However, no empirical estimaes of the number of people with problematic prescription opioid (PO) use exist to inform and guide intervention system needs.

Methods: The annual numbers of Canadian adults (≥ 15 years) with PO misuse and/or use disorders ('addiction') were estimated by combining data on the prevalence and associated 95% Confidence Intervals (CIs) of PO use in the Canadian population, obtained from national surveys, with PO misuse and use disorders transition probabilities, obtained from high-quality studies in recent meta-analyses. Uncertainty Intervals (UI) were estimated using Monte Carlo simulations.

Results: Population estimates of PO use were highest in 2008, with 5,967,046 (95% CI: 5,635,543–6,326,173) people using POs (representing 21.6% of adults), and lowest in 2015, with 3,941,935 (95% CI: 3,580,842–4,272,937) people using POs (13.1%). Furthermore, PO misuse and use disorders were highest in 2008, with 1,408,223 (95% UI: 878,686–1,951,211; 5.1% of adults) and 525,100 (95% UI 258,288–801,472; 1.9%) people with PO misuse and use disorders respectively. These numbers declined to 930,297 (95% UI: 576,083–1,295,310; 3.1% of adults) and 346,890 (95% UI: 168,310–532,941; 1.2%) people with PO misuse and use disorders, respectively, in 2015.

Conclusion: While seemingly declining over-time, the crude population estimates for problematic PO use were high, likely outweighing current intervention capacities. Furthermore, these estimates do not account for the delay of onset and duration of PO misuse and disorders. Thus, more rigorous problem population estimates should be generated to guide interventions.

1. Introduction

Opioid-related harms – popularly dubbed the 'opioid crisis' – continue to negatively impact public health in Canada on an unprecedented scale, primarily as a consequence of years of excessive opioid prescribing (Fischer et al., 2016b, 2017; Gladstone et al., 2015; Gomes et al., 2017). Concrete national population-level data on key parameters of opioid use and harms are available mainly for two major indicators: 1) 'upstream' (e.g., volume of prescription opioids (POs) dispensed medically, and 2) 'downstream' (e.g., opioid-related mortality and morbidity). In Canada, 34,444 defined daily doses (DDD) of opioids were dispensed in the period 2013–15, a 140% increase since 2003–05 [14,133 DDD] (International Narcotics Control Board, 2007, 2017). Furthermore, there were 2816 opioid-related overdose deaths in 2016 and 5570 opioid-related hospitalizations in the period 2016-17 (Canadian Institute for Health Information, 2017; Health Canada, 2017c); both of these indicators have also risen substantially over the past decade. Quantitative data for – e.g., opioid-related substance use treatment admissions do not exist at the national level, and are available only for select provinces (Fischer et al., 2016a).

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https://doi.org/10.1016/j.drugalcdep.2018.04.024
Received 6 March 2018; Received in revised form 27 April 2018; Accepted 30 April 2018
Available online 29 May 2018

Key indicators missing in Canada are empirical data on the size of the populations with risky or problematic PO use, namely those individuals at elevated risk for morbidity or mortality (including opioid use disorders and fatal/non-fatal overdose) outcomes, and therefore assumed to be in need of professional help or intervention services. While such data are available elsewhere (e.g., in the United States [US] (Parker and Anthony, 2015; Saha et al., 2016), they are absent in Canada, also due to the lack of respective diagnostic items in preeminent population surveys. However, such epidemiological information is needed to quantify and inform adequate intervention responses, and system capacity needs as part of the policy efforts to tackle the 'opioid crisis' in Canada. To fill this data gap, we have generated crude estimates of the sub-populations with PO misuse and use disorders ('addiction') in Canada, based on available scientific data sources and methods.

2. Methods

To compute annual estimates of the number of individuals with PO-related misuse and use disorders, we relied on the following data and indicators: a) population-level measures of PO use/exposure in the Canadian population and b) empirical transition probabilities from PO use/exposure to problematic use outcomes – concretely PO misuse and use disorders — available for the past decade. For population-level measures, we identified the annual past-year prevalence of PO use in Canada from respective national population (15 years of age and older) surveys for the years 2008–2015 (i.e., The Canadian Alcohol and Drug Use Survey [CADUMS] (Health Canada, 2014), The Canadian Tobacco, Alcohol and Drug Survey [CTADS] (Health Canada, 2017a)). The surveys defined PO use as overall use of opioid pain relievers in the past year (Health Canada, 2014, 2017a). The PO use rates from these surveys are generally consistent with provincial-based administrative data on the rates of people receiving prescriptions for opioids (e.g., Health Quality Ontario, 2017). The survey-based annual prevalence values and associated 95% Confidence Intervals (CIs) were converted into population totals (based on respective population size data from Statistics Canada) (Statistics Canada, 2017).

Transition probabilities for PO misuse and use disorders among individuals exposed to POs (medically) were based on the pooled analyses of 13 and 10 high-quality studies, respectively, from the systematic review by Vowles and colleagues (2015). 'Misuse' was defined as any use contrary to the directed or prescribed pattern of use, while 'addiction' was defined by a cluster of symptoms (e.g., including persistent and difficult-to-control use, craving, withdrawal and tolerance and related harm). We replaced the term 'addiction' with 'use disorder' as the current diagnostic term (Degenhardt et al., 2015; Vowles et al., 2015). Findings from the review indicated that among individuals exposed to POs, 23.6% (95% CI: 14.7%–32.5%) – 24.5% (95% CI: 15.7%–33.3%) developed misuse, and 8.8% (95% CI: 4.3%–13.3%) – 9.8% (95% CI: 5.0%–14.6%) developed use disorders, respectively (Vowles et al., 2015). Other reviews have resulted in similar estimates (Minozzi et al., 2013).

The annual prevalence of PO misuse and use disorders was estimated by multiplying the PO prevalence in a given year by the transition probability. The minimum prevalence rates (including the 95% CIs) were selected for use towards generating more conservative estimates when a range of values was reported (which were not appreciably different from the maximum values). This method, however, does not account for a delay in onset of PO misuse and use disorder outcomes following exposure. The 95% Uncertainty Intervals (UI) for the annual estimates of individuals with PO misuse and use disorders were computed by way of the 2.5th and 97.5th percentiles of 100,000 Monte Carlo-like simulations as recommended (Kalos and Whitlock, 2008; Robert, 2004). No correlation between the prevalence of PO use and the fraction of the individuals who developed opioid misuse and/or use disorders was assumed. Goodness-of-fit statistics for the Monte Carlo-like simulations were not possible as population-level data on the prevalence of PO misuse and use disorders are not available for Canada.

3. Results (see Table 1)

PO use was estimated to be highest in 2008, with 5,967,046 (95% CI: 5,635,543 – 6,326,173) individuals using POs, representing 21.6% (95% CI: 20.4%–22.9%) of the adult (≥ 15 years) population. PO use estimates subsequently decreased, with 3,941,935 (95% CI: 3,580,842–4,272,937) individuals using POs in 2015, representing 13.1% (95% CI: 11.9%–14.2%) of adults. The derived annual estimates of PO misusers were highest in 2008, with an estimated 5.1% (95% UI: 3.2%–7.1%) of adults, or 1,408,223 (95% UI: 878,686–1,951,211) individuals with PO misuse, and lowest in 2015, with an estimated 3.1% (95% UI: 1.9%–4.3%) of adults, or 930,297 (95% UI: 576,083–1,295,310) individuals with PO misuse. Similarly, the prevalence estimate of PO use disorders was highest in 2008, involving 1.9% (95% UI: 0.9%–2.9%) of adults, or 525,100 (95% UI: 258,288–801,472) individuals with PO use disorders, and lowest in 2015, involving 1.2% (95% UI: 0.6%–1.8%) of adults, or 346,890 (95% UI: 168,940–532,941) individuals with PO use disorders. All other annual values ranged in between these highest and lowest annual estimates.

4. Discussion

Based on the best available evidence, we have presented estimates of the annual numbers of people assumed to have developed PO-related problems – i.e., PO misuse and PO use disorders – due to PO exposure in Canada between 2008 and 2015.

These estimates have several key limitations which affect their interpretation. First, the estimates rely on population survey-based exposure data for POs, which include both medical and non-medical use, but exclude other forms of opioid use (e.g., illegal/non-medical opioid products). Second, the estimates rely on binary or straightforward estimates of use, and do not consider stratifying factors known to predict risk for problematic use outcomes (e.g., length or dosage of PO use) (Boscarino et al., 2010; Edlund et al., 2014; Sehgal et al., 2012). Third, the 'misuse' and 'use disorder' estimates are based on cross-sectional data from chronic pain populations with varying outcome definitions (Vowles et al., 2015) (instead of general PO-involved populations to which the transition probabilities were applied). Additionally, we present cross-sectional estimates for annual PO user and problem outcome populations, and not cumulative estimates over-time. The latter estimates would need to focus both on incidence estimates, i.e., 'new' users (in the past year), which for example in Ontario includes about two-thirds (63%) of those with current prescriptions of opioids (Gomes et al., 2017), as well as consider duration estimates, and cure and mortality rates, for the problem outcomes of interest. Therefore, our population-level estimates are presented as if the problem outcomes of interest were imminent in time. However, average lag-times between PO exposure and 'abuse' and 'disorder' outcomes have been assessed, based on US-based survey data, to approximately be between two (2.6) and three (2.9) years, respectively (Wu et al., 2011).

Despite their crude nature and limitations, our estimates of the annual populations with problematic PO-related outcomes for recent years in Canada are a first of their kind and should be helpful for intervention and policy development purposes. They characterize the size of the populations most likely to be at risk for consequential PO-related morbidity and mortality (e.g., overdose), and indicate the high need for targeted interventions (e.g., secondary prevention, substance disorder treatment). Annual estimates of PO users and consequentially related problem outcomes were estimated to be declining, mainly due to decreasing overall levels of PO dispensing and exposure following a variety of policy interventions in more recent years (e.g., post-2012) (Fischer et al., 2014b, 2015; Health Quality Ontario, 2018). However,